

ARCHES NATIONAL PARK RESEARCH SUMMARY 2008

1) Study Title: The Moab Project Site Environmental Air Monitoring Program
Conducted by the U.S. Department of Energy's Grand Junction Office

Permit No.: ARCH-2008-SCI-0012

Principal Investigator: Ed Baker

Purpose of Scientific Study: DOE's environmental air monitoring program will monitor local and background air quality for various radioparticulates (Uranium, Th-230, Ra-226 and radon-222).

Findings/Accomplishments for 2008: The air monitoring station at Arches is one of 13 stations operated by the US Department of Energy to detect levels of radiation on the DOE mill tailings site and off site. The Arches station is ~1/4 mile down wind of the project activity. No elevated levels of radiation have been detected at Arches. As the tailings is excavated and transported to Crescent Junction, the Arches station will continue to record data. See DOE "Environmental Air Monitoring Data Quarterly Report" on the Moab UMTRA Project web site (<http://www.gjem.energy.gov/moab>) for more information.

2) Study Title: Delicate Arch Trailhead Restoration Project

Permit No.: ARCH-2008-SCI-0013

Principal Investigator: Tamsin McCormick

Purpose of Scientific Study: The Delicate Arch trailhead restoration project was designed to improve native habitat along part of Salt Wash, a critical water source for wildlife in Arches NP. It was also designed to visually enhance this highly visited area and to inform members of the public of impacts from weed invasions and demonstrate how the public can be part of the solution. 2008 marked the second year of our activities on this project. Following removal in 2007 of tamarisk stumps, slash and salt-laden duff remaining from previous treatments along approximately 100 meters of the west bank, the site was ready for initial planting in Spring, 2008. The intent of this year's restoration efforts was not only to re-introduce a diversity of native plants, but also to encourage their success by removing competing annual weeds (especially tumbleweed and cheatgrass) and watering regularly through the hot, dry summer months. The project has a strong educational component for the volunteers who perform hands-on work as part of our organization's service-learning program, which includes optional college credit through Utah State University.

Findings/Accomplishments for 2008: Prior to transplanting, the planting site was again cleared of dead Russian Thistle that had sprouted the previous year. Approximately 170 transplants of grasses, shrubs and forbs were installed during the first two weeks of March 2008. These were plants at risk, collected (with approval) from roadsides along the 4x4 road in Salt Valley and from the path of construction for the new footbridge near Wolfe Cabin. Grasses included Sand Dropseed, Indian Ricegrass and Alkali Sacaton; shrubs and forbs included winterfat, ephedra, broom snakeweed, purple aster, and astragalus (two species). In addition, seed was collected along lower Courthouse Wash in ANP and placed in planting wells around new transplants. Approximately 100 cuttings of willows and cottonwoods from Courthouse Wash were also pole planted within the scour zone of the creek, to ensure adequate year-round water.

Fifty-seven volunteers, mostly college and middle-school students in our educational conservation service-learning programs, contributed over 320 hours to the project in 2008. Following initial planting in March, volunteers and staff watered in transplants at least once a month through July, and cleared the transplant areas of annual weeds including Russian Thistle and cheatgrass.

Approximately 40% of the transplants survived through July, especially grasses. Because this trail was under construction most of March and April, visitors hiking to Delicate Arch were directed to a detour that brought them right beside our revegetation area, providing a valuable opportunity to engage numerous visitors in discussions about the project.

3) Study Title: Aquatic Macroinvertebrate Monitoring Protocol and Development (NPS I&M Program)

Permit No.: ARCH-2008-SCI-0014

Principal Investigator: Anne Brasher

Purpose of Scientific Study: National Park Service units of the NCPN have a need for long-term monitoring of aquatic macroinvertebrates and riparian habitats. Monitoring the condition of aquatic ecosystems, including intermittent and perennial streams, springs, seeps, tinajas, and hanging gardens, is a high-priority need because of the great significance of these resources to parks and because of their sensitivity to a wide range of human impacts. The need for monitoring protocols is particularly urgent due to the ubiquity of factors potentially impacting aquatic systems, including flow diversion, flow regulation, water pollution, alteration to riparian habitat, up-stream development pressures, upland / upstream land-use activities, and water-rights issues.

The National Park Service (NPS) Northern Colorado Plateau Network is developing long-term monitoring programs for aquatic ecosystems (streams, springs, seeps, tinajas, and hanging gardens). This study will provide new data in support of this program. Results will assist the National Park Service to manage water resources in Arches National Park.

Findings/Accomplishments for 2008: No activity was conducted this reporting year.

4) Study Title: Soil Survey of Arches National Park, Utah

Permit No.: ARCH-2008-SCI-0015

Principal Investigator: Victor Parslow

Purpose of Scientific Study: To provide an updated soil and ecological site inventory for Arches National Park (ARCH), that meets National Cooperative Soil Survey (NCSS) standards and park management and planning needs. The existing soil survey was conducted in the late 1970's and the early 1980's as part of the Grand County, Utah soil survey. This inventory was primarily designed as a tool in managing grazing lands and has been found to be too general to be useful for managing the park. Information is lacking to model salt movement, mitigate visitor impacts, identify and protect habitat of Threatened and Endangered species, and other park responsibilities.

Findings/Accomplishments for 2008: Soil inventory activities: Soil survey activities were conducted in Arches National Park in 2008. Traverses and transects of the landscape were conducted, and soil descriptions and plant inventory data recorded, in order to further develop the soil-plant-landscape-geology models which will be essential to the completion of the update of the Soil Survey and Ecological Site Descriptions. 11 soil/landscape observations were documented in FY 2008, and

soil samples were collected from 10 of these locations. These samples have been catalogued, and are stored in the Richfield USDA Service Center. A draft Soil Survey manuscript was submitted for review to the NPS and the Soil Survey Office in Phoenix, Arizona in January 2009.

2. Archaeological activities: As a result of the field work of 2008, no archaeological sites were recorded in Arches National Park. All cultural resources were successfully avoided. No cultural material was unearthed during the course of soil sample collection.

5) Study Title: Annual Forest Lands Inventory of Utah

Permit No.: ARCH-2008-SCI-0016

Principal Investigator: Renee O'Brien

Purpose of Scientific Study: The Interior West Forest Inventory and Analysis program is responsible for statewide inventories in eight states. The purpose of this ongoing inventory is to gather information on condition and trends of forest resources to assess plant diversity; fuels and potential fire hazards; condition of wildlife habitats; mortality and risk associated with fire, insects, or disease; and biomass, carbon storage, forest health and other general characteristics of forest ecosystems. Under the annualized inventory system, each field plot is visited one every 10 years, with approximately 10 percent of the total plots visited each year within a state. The FIA program produces a fiveyear report for each State.

Findings/Accomplishments for 2008: As part of the Annual Forest Land Inventory of Utah, field crews visited two plots at Arches National Park during the 2007 field season. The results of this ongoing inventory are periodically updated and made available at www.fs.fed.us/rm/ogden. The five-year report for the Utah inventory will be released in 2009. Site-specific summaries of field data will be sent to our NPS contact person at this unit.

6) Study Title: Impacts of Climatic Change and Land Use on the Southwestern U.S.

Permit No.: ARCH-2008-SCI-0017

Principal Investigator: Jayne Belnap

Purpose of Scientific Study: (1) the causes and timing of changes in alluvial environments (rivers, streams, hillslopes), such as flooding, the cutting and filling of arroyos, and sediment discharge; (2) the role of eolian dust for soil fertility, invasion of exotic species, hydrology, and surface stability in deserts; (3) the interaction of physical and biologic processes critical for ecosystem functions; (4) how climate in the southwest has varied over decades, centuries, and millennia; (5) how future climatic variations will affect the Southwestern land surface (in terms of erosion, sand-dune activity, dust-storm frequency, flooding, landslides,); (6) how past climatic changes and environments affected prehistoric cultures.

Findings/Accomplishments for 2008: This is a long-term project, with which we hope to understand climatic variability and its effects on dust production and soil fertility. Multiple years will be required to capture the full range of variability so that we may better understand the role of extreme events, as well as normal regimes.

7) Study Title: Carbon and Nitrogen Cycles in Arid Lands: The Role of Biological Soil Crusts as Influenced by Soil Surface Disturbance, Climate Change and Annual Grass Invasion

Permit No.: ARCH-2008-SCI-0018

Principal Investigator: Jayne Belnap

Purpose of Scientific Study: Models indicate the presence of a large carbon (C) sink at temperate latitudes in the northern hemisphere. Over thirty percent of lands

both globally and in the United States consist of semi-arid or arid landscapes. Very little is known about carbon dynamics in these regions. Biological soil crusts, composed primarily of cyanobacteria, algae, lichens and mosses, can completely cover plant interspaces in undisturbed areas, and constitute 70 percent or more of the living ground cover. These soil crusts can be the dominant source of nitrogen (N) for vascular plants. They fix C at a high rate and are critical for soil stability and aggregate formation, which is important in C storage. They also absorb significant amounts of CH₄. In areas where precipitation is low and soils have low fertility, native plants often rely on intact biological soil crusts to provide increased water and nutrient flow to the broadly scattered vegetation. Thus, there are many ways in which biological soil crusts influence biogeochemical cycles and the structure and productivity of the vascular plant community. Soil surface disturbance, invasive plants, and climate change have the potential to dramatically alter the structure and function of biological soil crusts. The current combination of recreational use and livestock grazing is resulting in unprecedented levels of surface disturbance on many arid lands. In regions that did not have substantial amounts of surface disturbance in the Holocene, biological soil crusts disappear readily when trampled by animals or vehicles. Exotic annual grasses are invading many of these areas.

Trampling and invasion results in reduced cover and changes in the species composition of biological soil crusts. This, in turn, leads to changes in processes such as decomposition, N and C fluxes, soil moisture, and nutrient availability to vascular plants. Decreases of only 1 percent of soil organic carbon in the top 10 cm of rangeland soils is equivalent to the total C emissions from all croplands nation-wide. Changes in climate regimes, such as a shift in the summer monsoonal boundaries in the western United States, are expected to influence the composition and physiological functioning of biological soil crusts. Various crust components have different photosynthetic and respiration responses to temperature and moisture. In addition, different crusts have different methane fluxes. Therefore, changes in the timing or amount of temperature and precipitation is expected to alter soil C and N fluxes through changes in physiological response or crustal composition. This, in turn, can significantly impact vascular plant productivity. This project will establish how alterations in species composition by surface disturbance, invasive grasses, and/or climate change may affect N and C inputs and fluxes, in different soils under different climatic regimes. Because current and expected changes in land use and climate will occur over millions of acres in western rangelands, impacts to soil crusts have the potential for dramatically affecting C cycles, N cycles, and vascular plant productivity over much of the western United States. In addition, semi-arid and arid ecosystems represent over one-third of the Earth's terrestrial surface, and most are covered by biological soil crusts. As human impacts are escalating both regionally and globally in these drier regions, the research questions posed in this proposal have significant implications for global C budgets as well.

Findings/Accomplishments for 2008: With this ongoing project, we are continue maintaining our experimental plots, and collect data. As we are looking at long-term effects of soil surface disturbance, we will continue to annually monitor change, and analyze data in the future.

8) Study Title: A study of the distribution of *Catocala benjamini* and related *Catocala* in northeastern Arizona and southeastern Utah.

Permit No.: ARCH-2008-SCI-0019

Principal Investigator: John Peacock

Purpose of Scientific Study: This research is a continuation of study ARCH-00009 on *Catocala benjamini*. The name "ute" has been proposed by Peacock and Wagner as a new subspecies of *benjamini* occurring in eastern Utah (Arches and Canyonlands

NP). The purpose of the present study is to collect females of the moth in an attempt to get ova. These ova will provide an opportunity to rear larvae of this subspecies in 2009. The larva and ova are as yet undescribed, and if the study is successful the larvae and ova will be described in subsequent scientific publications.

Findings/Accomplishments for 2008: Fermented fruit-baited traps were deployed in the Courthouse Towers area of Arches NP on 7 June 2008 and again on 8 June 2008. Adults of *Catocala benjamini* "ute" (a new subspecies of *C. benjamini* being described by Peacock and Wagner) were taken from the traps in the early morning of 8 and 9 June. Female moths (7 in all) were collected live and placed in paper bags in an attempt to collect ova. Fifteen adults (14 males, 1 female) were killed and preserved for further study (DNA analyses, etc.). The live female moths were fed sugar solution daily, and were returned to Ohio, where the last female died on 5 July. In all, 4 ova were collected from the 7 females, and two of the ova were still viable on 3 March 2009. If these ova survive to produce larvae, the larvae will be reared on leaves of *Quercus macrocarpa* in an attempt to get mature larvae for larval descriptions.

9) Study Title: Hydrology and geomorphology in Arid River Systems: A Case Study in Canyonland Country

Permit No.: ARCH-2008-SCI-0020

Principal Investigator: Anne Brasher

Purpose of Scientific Study: To study the hydrology and geomorphology of Courthouse Wash in Arches National Park. This study seeks to understand linkages among hydrologic, geomorphologic, and riparian characteristics to help predict stream health and stream channel trends in arid river ecosystems. The study will look at natural versus anthropogenic impacts to the system

Findings/Accomplishments for 2008: No activity was conducted this report year.

10) Study Title: Acoustic Monitoring in Arches National Park

Permit No.: ARCH-2008-SCI-0023

Principal Investigator: Skip Ambrose

Purpose of Scientific Study: The primary objective of this project is to provide basic acoustic data necessary for preparation of air tour management plans for ARCH. A secondary objective is to collect acoustic data that will be useful in preparing a soundscape management plan. Specifically, these data include:

1. Natural sound levels in the primary habitats/acoustic zones in ARCH during all seasons of the year; and
2. The influence of aircraft and other man-made noise on natural sound levels.

Findings/Accomplishments for 2008: No acoustic data were collected in 2008. 2009 plans include monitoring site(s) used in 2005.